

INSTRUCTION MANUAL

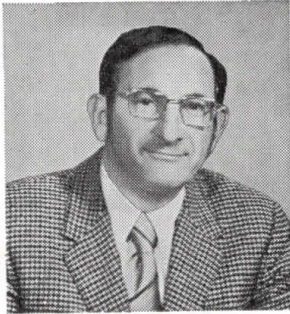


Model 281

DIGITAL MULTIMETER



Product of DYNASCAN CORPORATION
1801 West Belle Plaine Avenue, Chicago, Illinois 60613



Dear Friend:

Congratulations on your purchase of B & K—Precision Test Equipment, and welcome to the B & K family. We hope your experience with your new test equipment will make you a lifetime B & K customer.

Your instrument is backed by more than 20 years of experience in designing and manufacturing. Our most important goal is your satisfaction. At B & K, test equipment is made to meet the demands of the field focusing on dependability and accuracy. We also concentrate on simplicity and operating ease with features that reduce the possibility of human error and speed the servicing process.

In order to determine the type of test units that are needed we have been guided by letters and reports from technicians and engineers who use the equipment daily. Our field tests and studies have helped provide better and faster service techniques. Close contact has been maintained with the manufacturers of consumer products which our test units will be checking and trouble-shooting.

Key personnel in our company cut their eye teeth in the TV service business. This is why we have more "sensitivity" for the problems and conditions under which the test equipment will be used.

B & K product designs are constantly reviewed, and refinements are made or new models developed to meet advances in our industry and to fill your needs. We set our standards high so you can be assured that the B & K test instruments you buy represent advanced design, quality construction, and dependable long-term performance at a price you can afford.

If you have any comments or thoughts about our products, or test equipment in general, I would be delighted to hear from you.

Thanks for your confidence in B & K and we look forward to serving you for a long time to come.

Sincerely,

A handwritten signature in dark ink, appearing to read "Carl Korn". The signature is fluid and cursive, with a long horizontal stroke at the end.

Carl Korn
President

INSTRUCTION MANUAL

FOR

Model 281

DIGITAL MULTIMETER

B & K DIVISION OF DYNASCAN CORPORATION
1801 West Belle Plaine Avenue
Chicago, Illinois 60613

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INTRODUCTION

The B & K—Precision Model 281 Digital Multimeter is a significant contribution to the instrumentation market. Low cost and high performance have been engineered into this instrument to make available to the service technician, industry and training institutions a digital multimeter which is competitively priced with existing analog meters and which, at the same time, exceeds the performance of these meters. In addition, the basic instrument has been designed for maximum simplicity of operation and minimum error of reading.

The basic design features of this instrument make it an ideal replacement for existing VTVM's, multimeters and FET/VOM'S. The instrument is capable of measurement of DC and AC current and Ohms. The high input impedance—10 megohms on all voltage ranges—as well as the wide resistance range—10 ohms full scale to 10 megohms full scale—make this instrument an ideal replacement for conventional analog type instruments. In addition to providing equivalent functions and ranges, the inherent accuracy of this instrument provides a significant margin of performance.

SPECIFICATIONS

DC VOLTAGE

Ranges	± 0 —100mv, 1.00Volt, 10.0Volts, 100Volts, 1.00Kilovolt.
Overrange	100 percent to ± 199 mv, 1.99Volts, 19.9Volts, 199Volts, 1.5Kilovolts.*
Maximum DC Input ...	1500 Volts d-c or d-c plus a-c peak.
Accuracy	± 1 percent of full range, ± 1 digit.
Input Impedance	10 megohms
Polarity Switching	Function switch provides polarity reversal capability.
Wrong Polarity	
Indication	If a DC voltage of the wrong polarity is applied to the input, the first digit ("1") will remain on and the second and third digits will remain off.
Overrange Indication ..	If the input voltage exceeds 200 per cent of full scale, the first digit ("1") will remain off and the second and third digits will flash on and off together.

AC VOLTAGE

(peak-reading circuitry calibrated to read RMS value of pure sine wave)

Ranges	0—100mv, 1.00Volt, 10.0Volts, 100Volts, 1.00Kilovolt RMS.*
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*Do not exceed input level of 1500V dc or 1500V (dc+ac peak).

Overrange 100 per cent to 199mv, 1.99Volt, 19.9Volts,
 199Volts, 1.00Kilovolt RMS*.
 Maximum AC Input ...1000V RMS or 1500Volts peak.
 Accuracy ± 1.5 per cent of full range (Calibrated at 60 Hz).
 Frequency Response ... ± 1.5 per cent accuracy: 20Hz to 1000Hz.
 Input Impedance 10 megohms.
 Overrange Indication ..If the input voltage exceeds 200 per cent of full
 scale, the first digit ("1") will remain off and the
 second and third digits will blink on and off to-
 gether.
 *Do not exceed input level of 1000V RMS or
 1500V peak.

DC CURRENT

Ranges 0—100 μ a, 1.00ma, 10.0ma, 100ma, 1.00A.
 Voltage Drop
 (Measured at
 instrument terminals)..100mv, at full range.
 Overrange 100 per cent to 199 μ a, 1.99ma, 19.9ma, 199ma,
 1.99A.
 Accuracy ± 1.5 per cent of full range.
 Wrong Polarity
 Indication If a DC current of the wrong polarity is applied
 to the input, the first digit ("1") will remain on
 and the second and third digits will remain off.
 Overrange Indication ..If the input current exceeds 200 per cent of full
 scale, the first digit ("1") will remain off and
 the second and third digits will flash on and off
 together.

AC CURRENT

Ranges 0—100 μ a, 1.00ma, 10.0ma, 100ma, 1.00A.
 Voltage Drop
 (Measured at
 instrument terminals)..100mV RMS at full range.
 Overrange 100 per cent to 199 μ a, 1.99ma, 19.9ma, 199ma,
 1.99A.
 Accuracy ± 1.5 per cent of full range.
 Frequency Response ...20Hz to 1000Hz.
 Overrange Indication ..If the input current exceeds 200 per cent of full
 scale, the first digit ("1") will remain off and the
 second and third digits will flash on and off
 together.

RESISTANCE

Ranges	0—10.0ohms, 100ohms, 1.00Kohm, 10.0Kohms, 100Kohms, 1.00Mohm, 10.0Mohms.	
Oerrange	100 per cent to 19.9ohms, 199ohms, 1.99Kohms, 19.9Kohms, 199Kohms, 1.99Mohms, 19.9Mohms.	
Accuracy	± 2 per cent of range, 10.0ohms, to 1.00Mohm ± 3 per cent of range, 10.0Mohms range	
Test Voltage	0—10.0 ohm range, 0.1 Volt at full range; 100 ohms to 10.0Mohms, 1.0Volt at full range.	
Maximum Test		
Currents	10ohms	10ma
	100ohms	10ma
	1Kohm	1ma
	10Kohms	100 μ a
	100Kohms	10 μ a
	1Mohm	1 μ a
	10Mohms	100na

CIRCUIT PROTECTION

DC Volts, AC Volts Diode protection together with series current
limiting resistance.

Ohms Ranges Fuse and diode protection.

OPERATING TEMPERATURE RANGE

10°C to 40°C No degradation in accuracy.

POWER SOURCE 117V AC, 50/60Hz

POWER CONSUMPTION 15 Watts.

ACCESSORIES (Included) One test probe assembly, PR-21.
Instruction manual with schematic and
parts list.
Spare Ohms fuse (1/10A., 3AG).

DIMENSIONS 3 $\frac{1}{2}$ " x 7" x 9"

WEIGHT 5 lbs.

CONTROLS AND FEATURES

(SEE FIGURE 1)

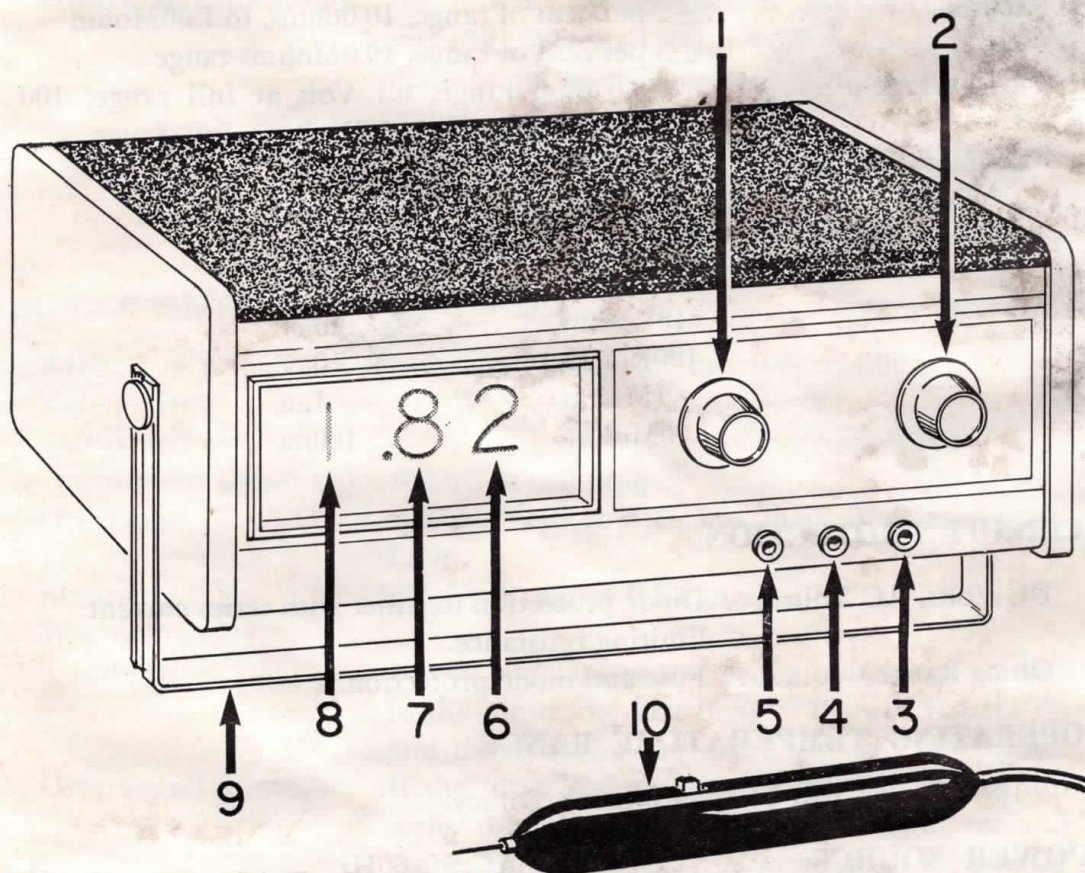


Figure 1. Operator's Controls and Facilities

1. FUNCTION switch
Selects the type of measurement to be performed. Also used to turn the instrument on and off.
2. RANGE switch
Selects the desired range for the measurement selected by the FUNCTION switch.
3. 1A jack
This jack is used when measuring dc and ac currents on the 1A range.
4. COM jack
This is the common connection to the instrument input.

5. (+) jack
This is the "hot" input jack. In dc measurements the test lead connected to this jack is normally applied to the positive potential point in the circuit under test when FUNCTION switch is in the +DCV position.
6. NUMERICAL READOUT DIGIT NUMBER 3
An indication between 0 and 9 is obtained, depending upon the value of the reading displayed. This digit is identified as the "3rd" digit.
7. NUMERICAL READOUT DIGIT NUMBER 2
A reading of 0 to 9 is obtained, depending upon the value of the measurement performed. This digit is identified as the "2nd" digit.
8. NUMERICAL READOUT DIGIT NUMBER 1
Either an off (no display) or a "1" is displayed, depending upon the value of the measurement performed. This digit is used when readings corresponding to full scale and over range are performed, and is identified as the "1st" digit.
9. Adjustable Handle
This handle can be used for carrying the instrument and can also be used as a tilt stand to raise the front panel to a convenient viewing angle when desired. The handle can be locked into any desired position by rotating it until it snaps into the position desired.
10. PR-21 Test Probe
This probe is used for all measurements performed. This probe is provided with a selectable 100 K Ω resistor which is used when performing dc measurements in high impedance or high frequency circuits. The resistor isolates the cable and input capacity of the meter from the circuit in which the measurements are performed. This reduces capacitive loading which may result in erroneous reading.

NOTE

When the probe resistor is used, a reading error of minus (–) one per cent is introduced because the 100K resistor value is placed in series with the internal 10 megohm divider. If this error is considered significant, the correction is made to the reading obtained by increasing the value of the observed reading by one per cent.

OPERATION

TABLE I
MEASUREMENTS AND INTERPRETATION OF
DIGITAL DISPLAYS

TO MEASURE		SET FUNCTION SWITCH	SET RANGE SWITCH	CONNECT RED LEAD	DIGITAL DISPLAY	
					FULL SCALE	100% OVERRANGE
+DCV/ -DCV	0-100 MV	+DCV/ -DCV	100 MV	(+) Jack	100	199
	0-1 V		1 V	(+) Jack	1.00	1.99
	0-10 V		10 V	(+) Jack	10.0	19.9
	0-100 V		100 V	(+) Jack	100	199
	0-1000 V		1 KV	(+) Jack	1.00	150*
AC VOLTS	0-100 MV	ACV	100 MV	(+) Jack	100	199
	0-1 V		1 V	(+) Jack	1.00	1.99
	0-10 V		10 V	(+) Jack	10.0	19.9
	0-100 V		100 V	(+) Jack	100	199
	0-1000 V		1 KV	(+) Jack	1.00	1.00**
DC CURRENT	0-100 μ a	DCA	100 μ a	(+) Jack	100	199
	0-1 ma		1 ma	(+) Jack	1.00	1.99
	0-10 ma		10 ma	(+) Jack	10.0	19.9
	0-100 ma		100 ma	(+) Jack	100	199
	0-1 Amp		1 A	1 A	1.00	1.99
AC CURRENT	0-100 μ a	ACA	100 μ a	(+) Jack	100	199
	0-1 ma		1 ma	(+) Jack	1.00	1.99
	0-10 ma		10 ma	(+) Jack	10.0	19.9
	0-100 ma		100 ma	(+) Jack	100	199
	0-1 Amp		1 A	1 A	1.00	1.99
OHMS	0-10 Ω	OHMS	10 Ω	(+) Jack	10.0	19.9
	0-100 Ω		100 Ω	(+) Jack	100	199
	0-1000 Ω		1 K Ω	(+) Jack	1.00	1.99
	0-10 K Ω		10 K Ω	(+) Jack	10.0	19.9
	0-100 K Ω		100 K Ω	(+) Jack	100	199
	0-1 M Ω		1 M Ω	(+) Jack	1.00	1.99
	0-10 M Ω		10 M Ω	(+) Jack	10.0	19.9

*Do not exceed input levels of 1500 VDC or dc+ac peak.

**Do not exceed input levels of 1000 VRMS or 1500 V peak.

Table I is provided as an aid in operation of the Model 281 and, in addition, provides interpretation of the displays obtained. Note that the decimal location changes with the changes in position of the RANGE switch. The significance of the decimal location must be known to assure proper interpretation of the readings obtained.

1. TURNING INSTRUMENT ON

- a. Set FUNCTION switch 1 to the OFF position.
- b. Connect the line cord to a 117 volt, 50/60 Hz source.
- c. Connect the test probe assembly 11 to the meter. Insert the dual-pin plug so that the (+) pin is inserted in the (+) jack 6 and the (-) pin is inserted in the COM jack 5. If it is desired to measure current in the 1 ampere range, the (+) pin is connected to the 1 A jack 4.
- d. Turn the instrument on by rotating the FUNCTION switch to the OHMS position.
- e. Without a resistance connected across the test leads, the overrange indication should occur, causing the first digit to be blanked and the second and third digits to flash on and off together. Shorting the test leads should produce a zero reading (first digit off and a "0" display on the second and third digits) with 100K probe resistor out.

2. DC VOLTAGE MEASUREMENTS

- a. Set FUNCTION switch 1 to the +DCV position if the voltage to be measured is positive with respect to common reference point, or to the -DCV position if the voltage to be measured is negative with respect to a common reference point. Make sure that the 100 Kohm resistor in the test probe is switched out, unless required to provide isolation when measuring d-c voltages in a high frequency circuit.
- b. Set RANGE switch 3 as required for the voltage amplitude to be measured. If the magnitude of the voltage is not known, set the RANGE switch to the highest position and reduce the settings as required to obtain a satisfactory reading.
- c. Connect the negative clip lead of the test probe assembly 11 to the common point of the chassis or equipment in which the measurements are to be performed.
- d. Touch the tip of the probe to the voltage point to be measured. A reading will be obtained if the polarity of the voltage corresponds to that selected by the FUNCTION switch. If the polarity is reversed, the polarity sensing circuit will be energized, causing the first digit to stay on and the second and third digits to remain off. Reset the FUNCTION switch to the polarity position required to obtain a reading.
- e. If the amplitude of the DC voltage measured is greater than twice that of the range selected, the overrange indication will become operative and the first digit of the display will remain off and the second and third digits will flash on and off together. The RANGE switch should then be adjusted to a higher range as required to obtain a satisfactory reading.
- f. Refer to Table 1 for correct interpretation of the reading displayed.

3. AC VOLTAGE MEASUREMENTS

- a. Place the FUNCTION switch in the ACV position.
- b. Switch out the 100 Kohm resistor in the test probe.

- c. Set the RANGE switch to the desired voltage range. If in doubt about the actual voltage amplitude to be measured, always use the highest voltage range for the first measurement and adjust the RANGE switch as required to obtain a satisfactory readout. If a voltage greater than twice that indicated on the RANGE switch is being measured the over range indication will become operative, and the first digit will be blanked and the second and third digits will flash on and off together. When this occurs, a higher voltage range must be selected.
 - d. Refer to Table 1 for correct interpretation of the reading displayed.
4. DC CURRENT MEASUREMENTS
- a. Place the FUNCTION switch to the DCA position.
 - b. Switch out the 100 Kohm resistor in the test probe.
 - c. Place the RANGE switch to the desired current range position.

CAUTION

Use care in selecting the current range to be measured. Make sure that meter is inserted *in series* with the load in which the current is being measured. Do not connect the meter in parallel with the voltage source connected to the load. A severe current overload can damage the current shunts provided in the instrument.

- d. When connecting the multimeter to read current in a circuit, the power to the circuit should first be removed. The following rules will insure that the proper current polarity is obtained.
 - (1) When inserting the test leads of the multimeter on the positive side of the power source which connects to the load, connect the positive lead of the test probe assembly at the voltage source and connect the negative lead to the load.
 - (2) When inserting the multimeter between the negative power source terminal and the load, connect the negative (black) test lead to the negative voltage terminal and connect the positive (red) lead to the load.

After the connections have been made to the circuit being measured, the power can be re-applied and the measurement performed.

- e. If the polarity of the current being measured is incorrect, the polarity sensing circuit will be energized, causing the first digit to stay on and the second and third digits to remain off. When this occurs the test lead connections in the external circuit must be reversed, *after first removing power to the circuit under test*.
- f. If the magnitude of the current being measured exceeds twice the amount indicated on the RANGE switch position selected, the over range circuitry is energized, causing the first digit to remain off and the second and third digits to flash on and off together. When this occurs *immediately* remove power from the circuit under test and select a higher current range before proceeding further.

- g. When using the 1A current range, the (+) tip of the test probe assembly must be connected to the 1A jack 4.
- h. Refer to Table 1 for interpretation of the digital readout obtained.

5. AC CURRENT MEASUREMENTS

- a. Set the FUNCTION switch to the ACA position.
- b. Switch out the 100 Kohm resistor in the test probe.
- c. Set the RANGE switch to the desired position. If in doubt about the magnitude of the current to be measured, use the highest current range and then adjust the RANGE switch as required to obtain a satisfactory reading.
- d. If the 1A position of the RANGE switch is selected, the (+) pin of the test probe assembly must be connected to the 1A jack.
- e. When connecting the multimeter for current measurements remove the power from the circuit being tested while the connections are being made. Do not make or break series connections to the circuit under test with power applied.
- f. If the magnitude of the current being measured exceeds twice the value of the range selected, the over range circuitry is energized, causing the first digit to remain off and the second and third digits to flash on and off together. When this occurs, *immediately* remove power from the circuit under test and select a higher current range before proceeding further.
- g. Refer to Table 1 for interpretation of the readings obtained.

6. RESISTANCE MEASUREMENTS

CAUTION

Do not attempt to measure resistance in a circuit in which the power is applied. Remove power and make sure that all capacitors are discharged before attempting in-circuit resistance measurements.

- a. Set the FUNCTION switch to the OHMS position.
If the OHMS circuit doesn't work, you may have burned out the ohms circuit fuse (F101) by making a resistance measurement in a "hot" circuit. To replace it, remove the two screws retaining the cover and carefully lift it off. Replace F101 (Figure 2) with the spare fuse clipped to the rear panel on the inside of the unit.
- b. Switch out the 100 Kohm resistor in the test probe.
- c. Set the RANGE switch to the desired position. Connect the test leads across the resistance to be measured.
- d. If the resistance value being measured exceeds twice the value of the range selected, the overrange circuitry is energized, causing the first digit to remain off and the second and third digits to flash on and off together.
- e. Refer to Table I for proper interpretation of the readings obtained.

When using the 10 ohm range, the third digit of the 281 may indicate some small resistance when the test leads are shorted together. This is the actual resistance of the test probe assembly. If this indicated value is considered significant, it should be subtracted from the resistance being measured. **DO NOT ATTEMPT TO CORRECT THIS RESIDUAL READING BY ADJUSTING THE INTERNAL ZERO ADJUST CONTROL OF THIS INSTRUMENT.**

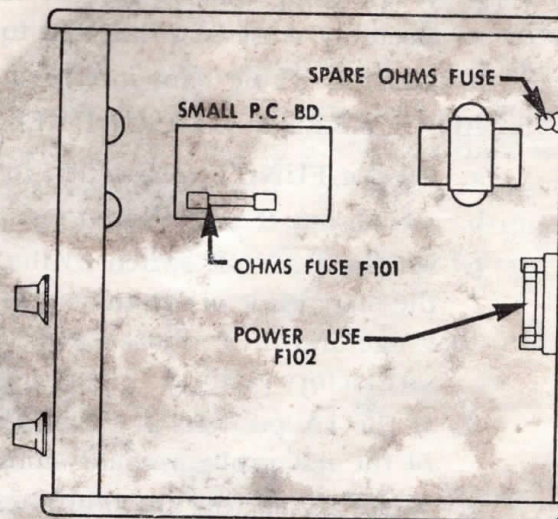


Figure 2.

MODEL 281 DIGITAL MULTIMETER THEORY OF OPERATION

(Refer to Figure 3. Block Diagram)

The Model 281 digital multimeter operates on largely the same principles as the common FET VOM, differing basically in the readout mode. The 281 incorporates a direct reading digital display.

The basic unit consists of a dc voltmeter with 100 mV capacity and 100% overrange capability. The higher voltage ranges are attained by the use of a precision switchable attenuator.

The ohms, ac volts, and current functions are developed by circuits which convert the unknown to be measured to a corresponding dc voltage. The unknown can then be handled as a dc voltage by the basic voltmeter.

The digital dc voltmeter consists of an impedance converter, an analog to digital converter, a digital counter, and readout indicators. Wrong polarity and overrange sensors are included to aid in correct use and interpretation of the readout. Circuit designations for major devices of each section are on the block diagram.

The impedance converter is a voltage follower that lowers the impedance of the input voltage without changing its magnitude, polarity or zero reference.

The analog to digital converter changes the output of the impedance converter to a series of pulses the number of which is proportional to the input

voltage in millivolts; i.e. $0\text{mV} = 0$ pulses, $10\text{mV} = 10$ pulses, $100\text{mV} = 100$ pulses, etc.

The digital counter counts the output pulses from the analog to digital converter and stores the count for display by the readout section.

The readout indicators display the number stored by the counter, up to 199 including the overrange digit; thus indicating the input voltage up to 199 millivolts. A voltage greater than 199mV applied at the input of the impedance converter would result in a count greater than 199. However, when the count reaches 200 the overrange sensor is activated, blanking the overrange digit and flashing the readout tubes, eliminating the possibility of operator confusion due to an erroneous display.

To read voltages higher than 199mV a switchable precision attenuator is placed between the input and the impedance converter such that the input voltage is divided by an appropriate multiple of ten so as to present 100mV to the impedance converter at the selected full range input voltage.

To read ac voltages an ac to dc converter is placed between the impedance converter and the analog to digital converter to translate the ac voltage to a proportional dc voltage readable by the dc voltmeter.

To read current a switchable precision shunt is connected across the input terminals. The shunt is selected such that at full range current the voltage drop across the input is 100mV. Thus the current is converted to a directly proportional voltage which can be read by the basic digital voltmeter.

To measure resistance a constant current source is connected to the input so that the voltage dropped is proportional to the resistance to be measured, thereby changing the resistance value to a dc voltage usable by the basic voltmeter circuitry.

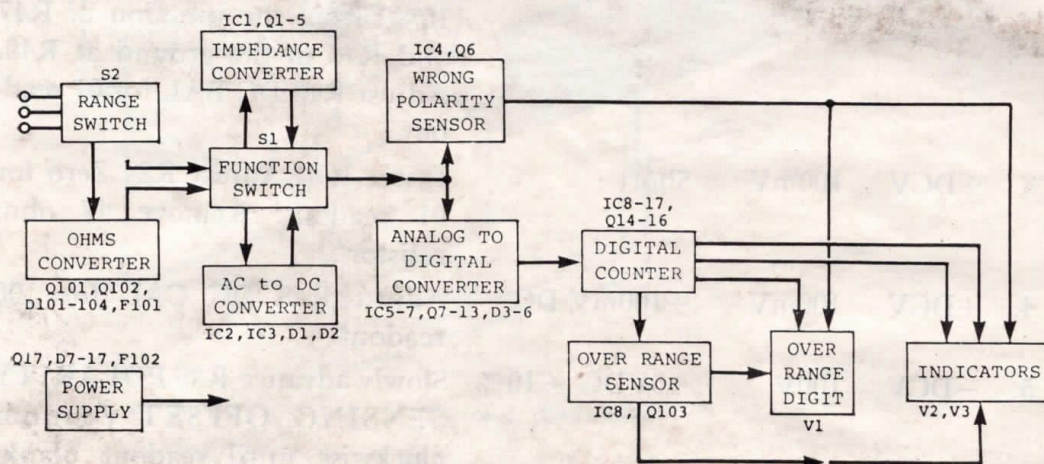


Figure 3. Block Diagram

MODEL 281 CALIBRATION PROCEDURE

The instrument should not require calibration unless repairs have been made that change the factory calibration. Prior to calibration the instrument should be checked for proper operation of all functions and for damage from physical abuse or unprotected overloads.

The following procedure should be performed with reference sources of .5% accuracy or better. Use of sources of less accuracy reduces the accuracy of the instrument.

The calibration is performed with the top and right side covers removed. To remove the top cover from the unit, the two screws holding the cover must be removed, then lift the back of the cover up and slightly forward to clear the tabs on the front panel.

To remove the right end panel from the unit, the top cover must be removed first, then the handle must be removed. To remove the handle, use a small screwdriver or solder aid to remove the right side retaining ring. When this is done the spring washer and handle stud can be removed. Repeat this procedure for the left side, and remove the handle. Then remove the three screws which hold the end panel. The end panel can then be removed from the unit.

To replace the handle put the spring washer on the handle stud with the bow facing the inside of the unit (see Figure 4). Using long nose pliers, grasp the center of the retaining ring and press it into the slot in the handle stud, holding the stud with your thumb.

FUNCTION	RANGE	SIGNAL AT INPUT	PROCEDURE
1.			Turn R36 POLARITY SENSING OFFSET pot full clockwise.
2. +DCV			Remove IC1 from socket. Connect a 47 ohm resistor (may be 10%) from the junction of R47 and R48 to the ground at R49. Adjust R40 DC BAL for 01 readout.
3. +DCV	100mV	Short	Insert IC1. Adjust R24 Zero for 01 readout. Remove 47 ohm resistor.
4. +DCV	100mV	+100mV DC	Adjust R48 DC CAL for 100 readout.
5. -DCV	100V	+5VDC $\pm 10\%$	Slowly advance R36 POLARITY SENSING OFFSET counter-clockwise until readout blanks and 1 comes on.

- | | | | | |
|-----|------|--------------|------------------|---|
| 6. | -DCV | 1KV | +5VDC $\pm 10\%$ | Readout should return to 00. If not, return R36 CW and repeat step 5. |
| 7. | ACV | 10V | 100mV | Adjust R32 AC ZERO for .01 readout. |
| 8. | ACV | 100V | 100mV AC | Readout should return to 00; if not readjust R32 and recheck step 7. Repeat until unit reads .01 on 10V range and 00 on 100V range. |
| 9. | ACV | 100mV | 100mV AC | Adjust R29 AC CAL for 100 readout. |
| 10. | OHMS | 1K Ω | 1.00K Resistance | Adjust R102 OHMS CAL for 1.00 readout. |
| 11. | OHMS | 10M Ω | 10.0M Resistance | Adjust R14 10 MEG CAL for 10.0 readout. |

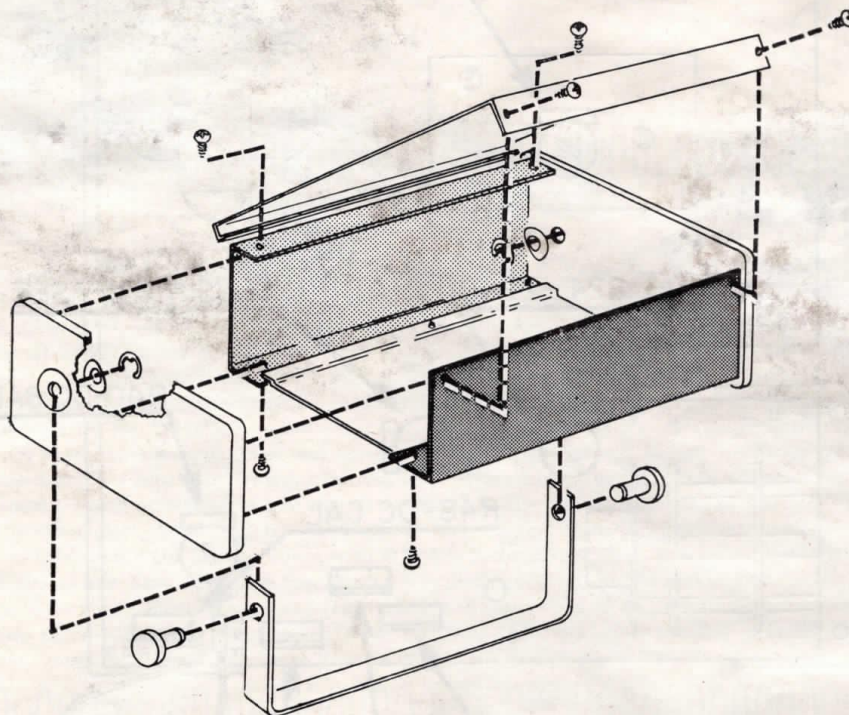


Figure 4. Disassembly

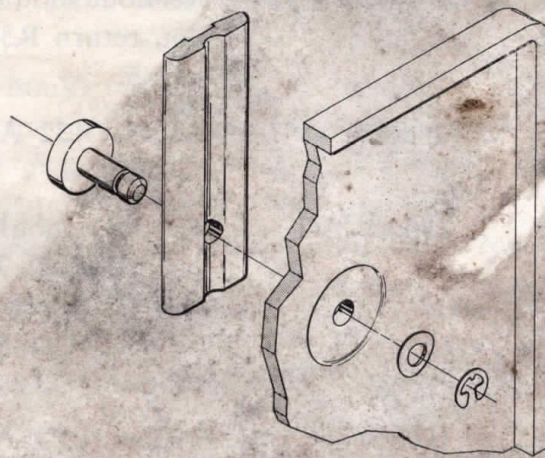


Figure 5. Handle Detail

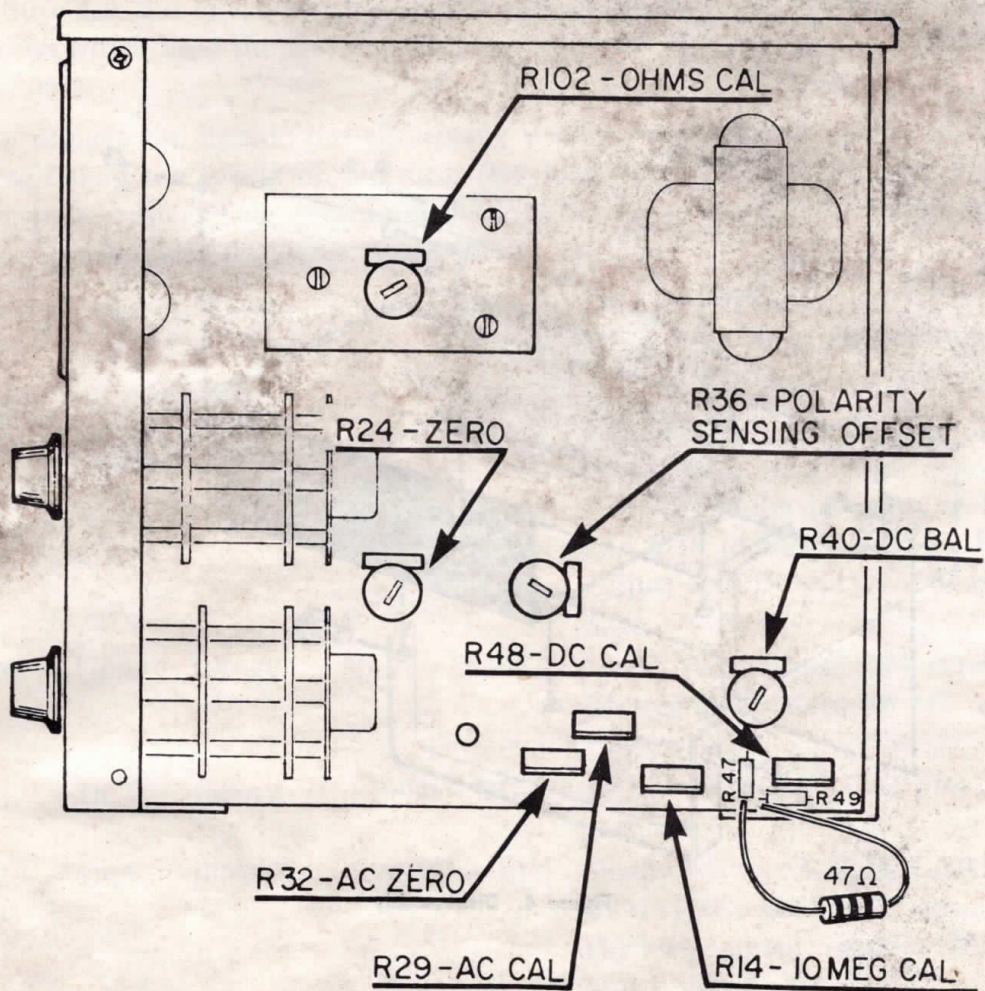


Figure 6. Location of Internal Adjustments

WARRANTY SERVICE INSTRUCTIONS

1. Refer to the maintenance section of the instruction manual for adjustments that may be applicable.
2. Defective parts removed from units which are within the warranty period should be sent to the factory, prepaid, with model and serial number of product from which removed, and date of product purchase.
3. If the above mentioned procedures do not correct the difficulty, pack the product securely (preferably double packed). A detailed list of troubles encountered must be enclosed as well as your name and address. Forward prepaid (express preferred) to the nearest B & K authorized service agency.

Contact your local B & K Distributor for the name and location of your nearest service agency, or write to:

Service Department

B & K DIVISION OF DYNASCAN CORPORATION
1801 West Belle Plaine Avenue
Chicago, Illinois 60613

WARRANTY

"B & K warrants that each product manufactured by it will be free from defects in material and workmanship under normal usage and service for a period of ninety days after its purchase new from an authorized B & K distributor. Our obligation under this warranty is limited to repairing, or replacing any product or component which we are satisfied does not conform with the foregoing warranty and which is returned to our factory or our authorized service contractor, transportation prepaid, and we shall not otherwise be liable for any damages, consequential or otherwise. *The foregoing warranty is exclusive and in lieu of all other warranties (including any warranty of merchantability), whether expressed or implied.* Such warranty shall not apply to any product or component (i) repaired or altered by anyone other than B & K or its authorized service contractor (except normal tube replacement) without B & K's prior written approval; (ii) tampered with or altered in any way or subjected to misuse, negligence or accident; (iii) which has the serial number altered, defaced or removed; or (iv) which has been improperly connected, installed or adjusted otherwise than in accordance with B & K's instructions. B & K reserves the right to discontinue any model at any time or change specifications or design without notice and without incurring any obligation. *The warranty shall be void and there shall be no warranty of any product or component if a B & K warranty registration card is not properly completed and postmarked to the B & K factory within five days after the purchase of the product new from an authorized B & K distributor.*"



DYNASCAN CORPORATION

1801 West Belle Plaine Avenue, Chicago, Illinois 60613

B & K MODEL 281 PARTS LIST

488-117-9-002D

SCHEMATIC
SYMBOL

DESCRIPTION

B & K
PART No.

RESISTORS

R-3, 8	1K, 1/2W, 1/2% P.F. Metal Film Resistor.....	011-016-9-001
R-4, 28	100Ω, 1/2W, 1/2% P.F. Metal Film Resistor.....	011-015-9-001
R-5	10Ω, 1/2W, 1/2% P.F. Metal Film Resistor.....	011-014-9-001
R-6	0.98Ω, 1/2W, 1/2% P.F. Wirewound Resistor.....	004-124-9-001
R-7	0.098Ω, 1/2W, 1/2% P.F. Wirewound Resistor.....	004-125-9-001
R-9	9K, 1/2W, 1/2% P.F. Metal Film Resistor.....	011-017-9-001
R-10	90K, 1/2W, 1/2% P.F. Metal Film Resistor.....	011-018-9-001
R-11	900K, 1/2W, 1/2% P.F. Metal Film Resistor.....	011-019-9-001
R-12	9M, 1W, 1/2% Deposited Carbon Resistor.....	002-001-2-905
R-13	72M, 2W, 2% Deposited Carbon Resistor.....	002-002-4-726
R-15	7.5M, 1W, 1% Deposited Carbon Resistor.....	002-001-3-755
R-16	750K, 1/2W, 1/2% P.F. Metal Film Resistor.....	011-047-9-001
R-17	75K, 1/2W, 1/2% P.F. Metal Film Resistor.....	011-046-9-001
R-18	7.5K, 1/2W, 1/2% P.F. Metal Film Resistor.....	011-045-9-001
R-19	750Ω, 1/2W, 1/2% P.F. Metal Film Resistor.....	011-044-9-001
R-20	470K, 1/2W, 5% P.F. Metal Film Resistor.....	011-102-8-474
R-21, 22	16K, 1/2W, 1% P.F. Metal Film Resistor.....	011-022-9-001
R-27	900Ω, 1/2W, 1/2% P.F. Metal Film Resistor.....	011-029-9-001
R-103	3.3K, 1/2W, 1% P.F. Metal Film Resistor.....	011-025-9-001

POTENTIOMETERS

R-14	10M Trim Pot (10M CAL).....	008-182-9-001
R-24	100Ω Carbon Pot (ZERO ADJUST).....	008-186-9-001
R-29	5K Trim Pot (AC CAL).....	008-057-9-001
R-32	5M Trim Pot (AC ZERO).....	008-161-9-001
R-36, 40	10K Trim Pot (POL. OFFSET, DC BAL).....	008-106-9-001
R-48	100Ω Trim Pot (DC CAL).....	008-131-9-001
R-102	1K Trim Pot (OHMS CAL).....	008-179-9-001

CAPACITORS

C-6, 13	22μfd, 16V, P.C. Electrolytic Capacitor.....	022-085-9-001
C-17, 31	47μfd, 16V, P.C. Electrolytic Capacitor.....	022-089-9-001
C-25, 26, 27, 28, 32	220μfd, 25V, P.C. Electrolytic Capacitor.....	022-083-9-001
C-29	10μfd, 250V, P.C. Electrolytic Capacitor.....	021-040-9-001
C-30	1000μfd, 16V, P.C. Electrolytic Capacitor.....	022-084-9-001
C-33	10μfd, 25V, Tantalum Capacitor.....	027-001-9-005
C-102	0.1 μfd, 1KV, 20% Molded Capacitor W/Bracket..	026-026-9-001

DIODES AND TRANSISTORS

D-1, 2, 3, 4, 5, 102, 103	Diode, Silicon (IN4148).....	151-038-9-001
D-6	Diode, Zener, 6.2V, 1W, 5% (IN4735A).....	152-037-9-001
D-7, 8, 9, 10, 11, 12, 16, 17, 101	Diode, Silicon, 1 AMP, 600PIV.....	151-018-9-001
D-13, 14	Diode, Zener, 12V, 1W 5% (IN4742A).....	152-039-9-001
D-15	Diode, Zener, 5.6V, 1W, 5% (IN4734A).....	152-036-9-001
D-104	Diode, Zener, 7.5V, 1W, 5% (IN4737A).....	152-038-9-001

COMPOSITE
499-040-9-001 E

**SCHEMATIC
SYMBOL**

DESCRIPTION

**B & K
PART No.**

DIODES AND TRANSISTORS (Cont.)

Q-1, 2, 5, 9, 10, 11, 12, 13, 102	Transistor, Silicon Signal, PNP	177-008-9-001
Q-3	FET, Dual N Channel (2N3956)	182-020-9-001
Q-4, 6, 14, 15	Transistor, Silicon Signal, NPN	176-023-9-001
Q-7, 8	FET, N Channel (2N5459)	182-003-9-001
Q-16, 103	Transistors, Silicon Signal, NPN (2N5550)	176-033-9-001
Q-17	Transistor, Silicon Power, NPN (D40A5)	172-005-9-001
Q-101	Transistor, Silicon Signal, PNP (2N6001)	177-010-9-001

INTEGRATED CIRCUITS

IC-1, 2, 4, 5, 6	741 Operational Amplifier	307-016-9-001
IC-3	748 Operational Amplifier	307-018-9-001
IC-7	710 Differential Comparator	307-017-9-001
IC-8	7402 Quad 2-Input N or Gate	307-011-9-001
IC-9	7400 Quad 2-Input N and Gate	307-015-9-001
IC-10, 13	7490 Decade Counter	307-012-9-001
IC-11, 14	7475 Quad Latch	307-013-9-001
IC-12, 15	7441 BCD-Decimal Decoder/Driver	307-014-9-001
IC-16, 17	7473 Dual J-K Flip-Flop	307-010-9-001

COILS, TRANSFORMERS, SWITCHES, & READOUTS

L-1	10 Microhenry, 10% Coil	041-055-9-001
T-1	Power Transformer 117 Volt Primary	065-069-9-001
T-1	Power Transformer 117/234 Volt Primary	065-069-9-002
S-1	P.C. Rotary Switch (FUNCTION)	090-003-9-001
S-2	P.C. Rotary Switch (RANGE)	090-004-9-001
V-1	Neon Indicator (NE-211)	401-013-9-001
V-2, 3	Nixie Tube (ZM-1000)	238-001-9-001

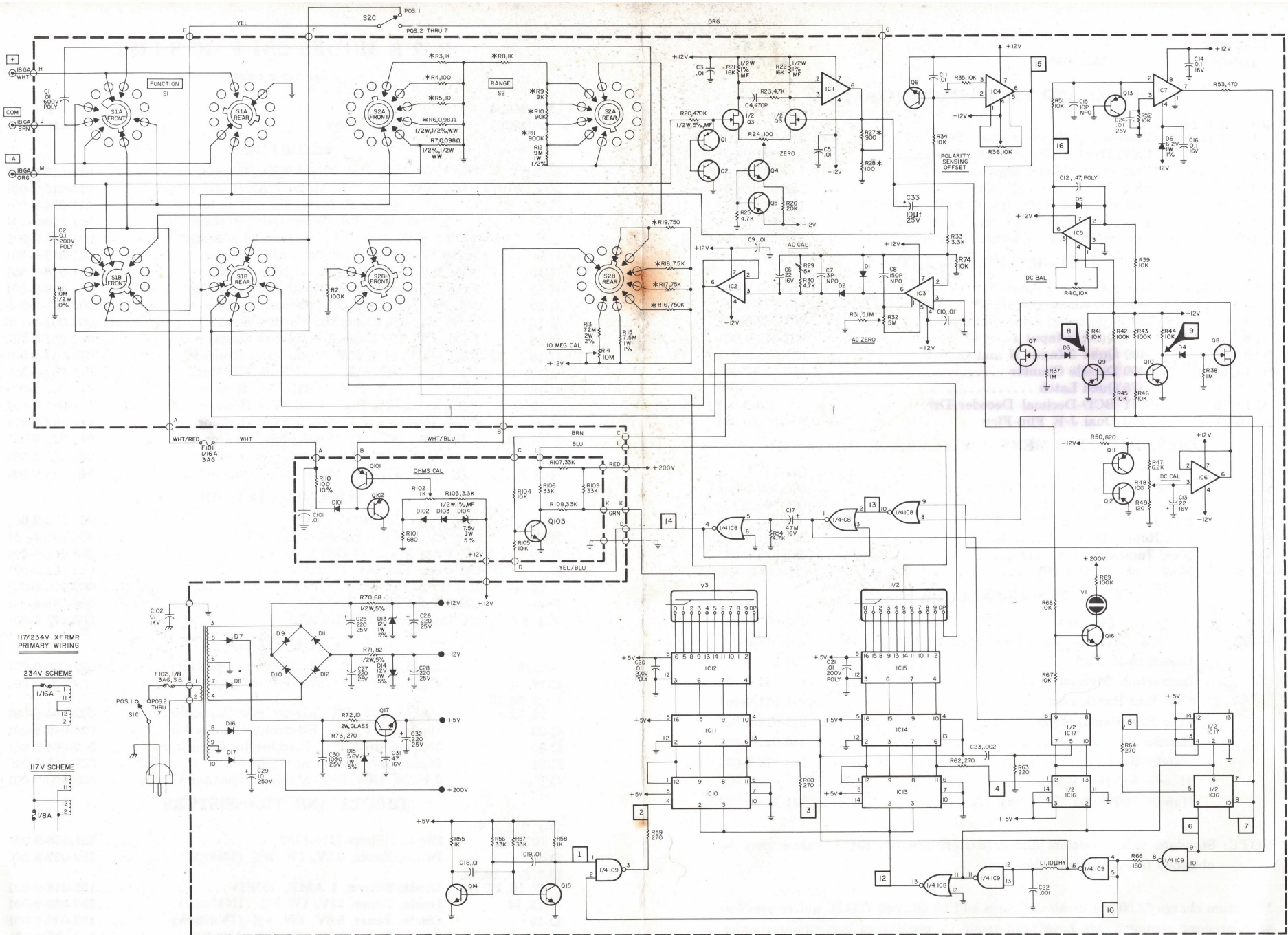
MISCELLANEOUS

F-101	1/8 Amp, 3 AG Fuse	191-005-9-001
F-102	1/8 Amp, 3AG SLO-BLO Fuse, Pigtail	193-011-9-001
	Direct/100K Probe	PR-21
	Instruction Manual	480-131-9-001
	Case End Panel, Left	271-011-9-001
	Case End Panel, Right	271-012-9-001
	Handle	746-021-9-001
	Handle Stud	763-018-9-001
	Handle Friction Washer	731-026-9-001
	Handle Retaining "E" Ring	741-049-9-001

NOTE: Standard value resistors and capacitors are not listed, values may be obtained from schematic diagram.

Minimum charge \$2.00 per invoice. Orders will be shipped C.O.D. unless previous open account arrangements have been made or remittance accompanies order. Advance remittance must cover postage or express charge.

Specify serial number when ordering replacement parts.



LAST NUMBER USED		
MAIN P.C.B.D.	OTHER	NOT USED
R73	RI10	RE1, 65
C32	CI02	
D17	DI04	
Q17	QI03	
IC17		